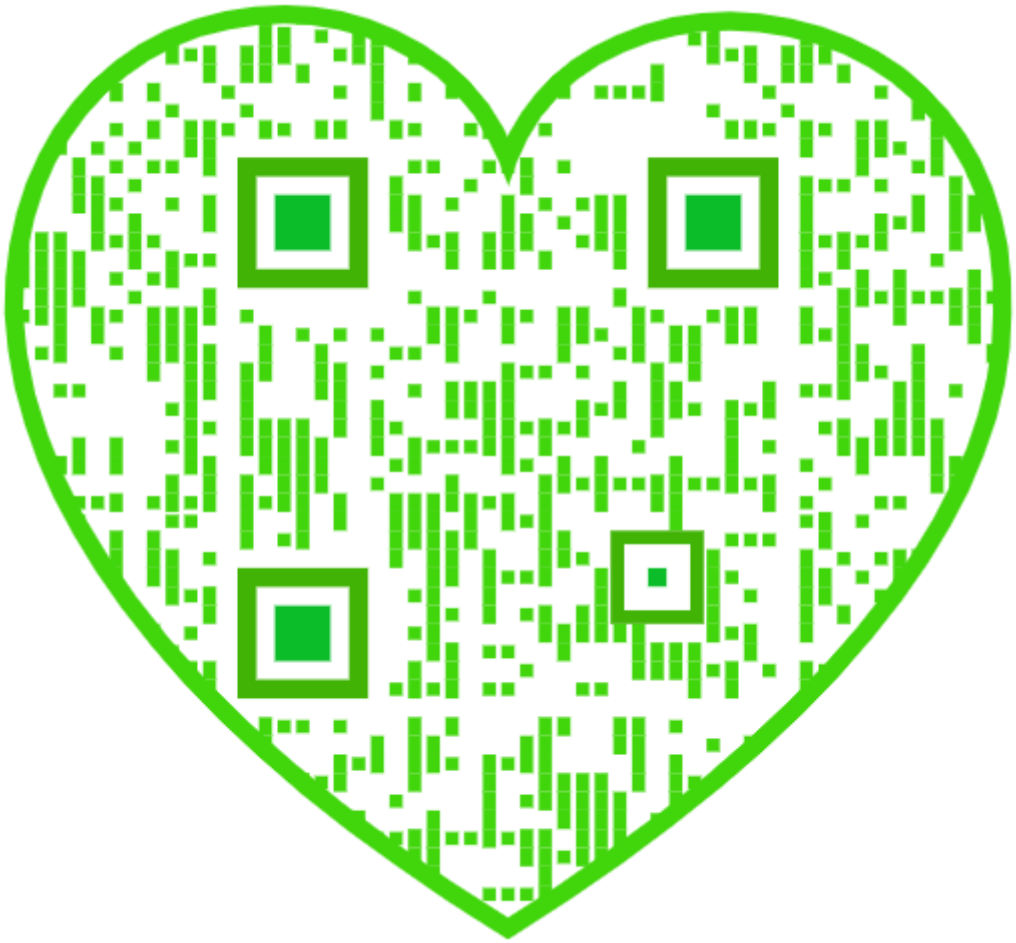

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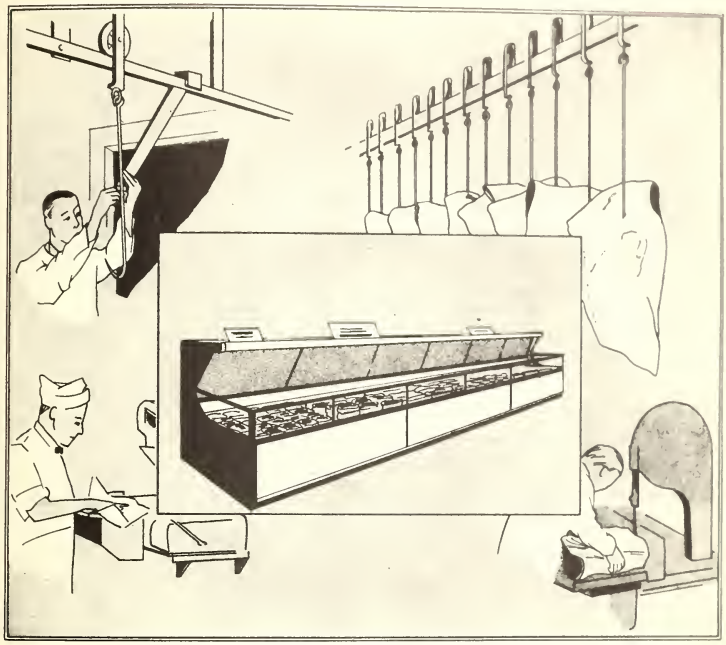
Receiving, Blocking, and Cutting Meats .....in Retail Food Stores.....



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The study on which this report is based was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

FOREWORD

During the last few years many studies have been made of various aspects of the marketing of farm and food products in order to find more economical methods of moving such products from the farm to the consumer. Retailing accounts for a substantial part of the total marketing bill, and it is in the retail store that the consumer decides whether to take a product or leave it. Hence, improvements in retailing are important not only to retailers but also to farmers and consumers.

Research to find ways to reduce the cost of retailing has been carried on in close cooperation with retailers by using their stores as laboratories in which to develop and test improved methods and equipment. Reports have already been published which show how to improve the check-out operation and the handling of groceries in self-service food stores.

This publication is the first of a number of reports setting forth the results of studies to find ways of improving the layout, work methods, equipment, and materials used in the meat departments of retail stores. These studies were made to determine how to reduce the cost of operating the meat department through improved methods of receiving, blocking, and cutting of meat. Subsequent reports are planned dealing with packaging and displaying of meats in self-service markets, packaging materials, customer service, and display in service meat markets, and the effect of layout and other improvements on operating costs.

The improved methods of handling described in these reports have already been tested under actual operations. Thus, the reports will show the improvements in productivity that have been achieved. It is hoped that the results of this work will help retail meat dealers throughout the country to reduce their operating costs.

WILLIAM C. CROW, Director
Marketing and Facilities
Research Branch

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SUMMARY

The application of selected improvements in methods, materials, and equipment to the cutting operation in the meat department of one retail store, and to the receiving, blocking, and cutting operations in three other stores, increased the productivity for these operations by 26.6, 36.3, 36.3, and 38.9 percent in the respective stores. These improvements represented a reduction in labor requirements in these four average-size markets of 8.5, 14.1, 16.0, and 28.4 man-hours per week.

As conventionally performed, the receiving and blocking (dividing into wholesale-size cuts) accounted for approximately 3 percent of the total meat department man-hours and the cutting (dividing into retail-size cuts) accounted for 15 to 30 percent. Motion and time study techniques were used to measure productivity of these functions as they were being performed before the study was made, and an attempt was then made to increase productivity in each operation through the development of improved handling methods, equipment, and layout.

In the receiving operation, the use of the overhead meat rail in receiving sides of beef increased productivity from 7.87 to 13.26 sides per man-hour--68.5 percent more production than in receiving without a rail. Improved methods of receiving with the meat rail, and the use of a meathook stabilizer, resulted in the meat rail being 82.1 percent more productive than receiving without a rail. In addition, the meat rail eliminated much of the heavy lifting in the handling of beef quarters and veal sides. The labor requirements for receiving nonrail stock items were reduced by increasing the size of the order received, where practical, and by placing the items at the point where they were to be processed in the market.

The most productive blocking operation was achieved by utilizing the overhead meat rail and by hanging the forequarter in the chuck rather than in the rib to minimize lifting and to facilitate trimming the quarter. The use of the spinal-cord remover and the calibrated knife and improved blocking methods reduced the time to block a hindquarter from 8.5 man-minutes to 6.3 man-minutes and a forequarter from 10.8 man-minutes to 8.0 man-minutes.

In the cutting operation the best productivity was obtained with a new type of cutting table together with a revised workplace arrangement, by using the power saw with a smear remover attachment to remove bone and fat smear from the meat. The use of the power saw in place of the hand saw, knife, and cleaver reduced the cutting time per package from 0.295 man-minute to 0.182 man-minute, and the power saw provided an average increase in production of 62.1 percent for five representative items in one market. The use of the smear remover increased production over conventional power saw methods, for those cuts requiring cleaning, by 21.5 percent in one market and 32.5 percent in another. The use of a

hand saw with a blade that was part knife and part saw increased production for cutting hams by 44.4 percent over the use of the hand saw and the knife.

The improved workplace arrangement reduced walking time and placed all tools and materials within easy reach of the operators. The bone- and fat-receiving barrels, trimming cans, empty pans, wrapping paper, strings, knives, and other tools also were pre-positioned within easy reach. This workplace arrangement reduced space requirements 25 percent and increased production 10 percent.

RECEIVING, BLOCKING, AND CUTTING MEATS IN RETAIL FOOD STORES

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INTRODUCTION

About 248,500 retail grocery stores in the United States were selling meat as of January 1, 1952, according to trade estimates. 1/ Thousands of these stores had either complete or partial self-service meat departments. During 1952, the number of stores selling meat by self-service increased about one-third. With the rapid adoption of this new method of merchandising, new problems are confronting store operators. Many operators are using makeshift methods, procedures, and equipment to prepare their meats for sale through the self-service display case.

The largest single item of expense in retail food stores is the cost of labor. The self-service meat departments of the stores studied required about 25 percent of the total labor hours in the stores. Direct labor and packaging materials costs--the two items of principal concern in this report--averaged 54 and 57 percent of the total costs of selling meat in the stores studied.

Studies were made of all major functions in service and self-service retail meat markets for the purpose of finding ways to increase the productivity of labor and reduce packaging materials costs through improving methods, materials, equipment, and layout. Any reductions in the cost of handling meat at retail should not only benefit the retailer but, through lower retail prices and increased volume, should benefit the consumer and the farmer. The individual employees should also benefit through increased wages for increased productivity.

The methods and equipment used in a number of stores of several different food-store chains in various parts of the country were examined before detailed studies were made. Close examinations of the operations in 52 stores of 3 companies in the southeastern part of the country were made, and 26 stores were selected for detailed studies. (The procedures used and the types of data collected are explained under "Methodology" on page 41.)

Four retail stores, representative of the 26 selected for detailed study, were analyzed to determine the relative amounts of time required to

1/ Facts in Food and Grocery Distribution, January 1952. (Published by The Progressive Grocer, 161 Sixth Ave., New York, N. Y.)

perform the various functions in the meat departments. The results of these studies in the two self-service and two service markets are shown in table 1.

Table 1.—Percentages of total market time requirements to perform the handling operations for retailing meat in two self-service and two service markets in the southeastern part of the United States, 1952

Handling operation for retailing meat	Percentage of total market time in--			
	Self-service market		Service market	
	100-percent self-service	90-percent self-service	55-percent self-service	50-percent self-service
	Percent	Percent	Percent	Percent
Receiving	0.9	2.7	1.4	2.8
Blocking	1.3	1.0	2.1	.9
Cutting 1/	29.5	25.1	20.9	14.8
Prepackaging	37.2	27.4	16.1	13.6
Display	14.4	13.0	11.2	13.4
Customer service 1/	2.9	13.6	29.0	30.9
Clean up	6.3	6.0	9.4	6.4
Ordering	1.0	1.6	1.2	1.1
Personal time	1.3	4.5	2.6	3.7
Miscellaneous	5.2	5.1	6.1	12.4
Total	100.0	100.0	100.0	100.0

1/ Some cutting, for special orders, was included in customer service.

As shown in table 1, the functions of receiving, blocking, and cutting of meats represented about 30 percent of the meat department labor hours in the self-service markets studied, and about 20 percent in the service markets. Receiving accounted for 1 to 3 percent of the total market-labor hours and blocking required 1 to 2 percent. Cutting involved about 25 to 30 percent of the total market-labor hours in self-service markets and about 15 to 21 percent in service markets. Since these meat-handling operations usually are performed by skilled employees, the labor cost for such operations is proportionately higher than that for other operations; thus, savings in labor hours for these operations will result in proportionately greater dollar savings than those for the other operations.

Receiving, as defined in this report, comprised the operation of obtaining incoming merchandise from the delivery trucks, checking it on the various sheets or forms used, and placing it in temporary storage. In this study the receiving function considered was only the labor expended by the personnel of the store. This varied, however, for certain items according to the practice of the delivery personnel in handling the merchandise.

In most cases the items were delivered by the deliveryman direct from the truck to the cutting room or to the meat cooler and the market personnel checked or counted the items. Quarters of beef delivered into a store having a meat rail were usually carried only to the rail and placed on the hooks. The market personnel then pushed the items to the scales and into the meat cooler. (Appendix table 15 shows a production standard for receiving sides of beef on the rail and indicates the method used to prepare production standards for the receiving operation.)

Blocking involved dividing the forequarters and hindquarters of beef, and sides of veal and lamb, into wholesale cuts. This often included some conditioning of the carcasses, such as the removal of excess fat or dark meat from the carcasses as the meat was being separated into wholesale cuts. (Appendix table 16 shows a production standard for blocking hindquarters of beef hung on the rail and indicates the method used to prepare standards for the blocking operations.)

Cutting involved dividing the wholesale cuts into retail cuts. This included a great deal of boning and trimming, cutting up whole fryers, slicing luncheon-meat items, and grinding beef. In items such as ground beef, stew beef, and fryers, it included placing the items on the trays. (Appendix table 17 shows a production standard for cutting T-bone steaks and indicates the method used to prepare standards of the cutting operation.)

THE RECEIVING OPERATION

Receiving involved from 0.9 to 2.8 percent of the total meat department labor in the stores studied and was generally handled by the head meat cutter or the market manager. It involved answering the bell at the back door, directing the truck drivers where to place the meat items, weighing or counting the items and checking them for quality, checking and signing the invoice, and, if necessary, moving the items from where the truck drivers had placed them into storage or into position for the next operation. Beef, veal, and lamb carcasses were usually received by hand but were handled on an overhead rail when the markets were equipped for that. All other meat items and supplies were carried by hand or by two-wheel hand trucks.

Use of the Overhead Meat Rail in Receiving Beef, Veal, and Lamb Carcasses

Without question, the greatest value of the meat rail was elimination of much heavy lifting in the handling of beef quarters. In addition, considerable time was saved in receiving and blocking beef, veal, and lamb on the rail. Time studies in one market indicated that the use of the rail for receiving beef quarters had raised productivity from 7.87 sides per man-hour to 13.26 sides per man-hour, an increase of 68.5 percent. On the basis of 8 sides of beef received per week the savings amounted to 24.8 man-minutes a week for receiving beef quarters only.

Conventional method

In the conventional method of receiving beef on the rail, the hindquarter was hung on a short hook in the hind-shank loop (fig. 1). The forequarter was hung with the long meat hook placed on the inside of the quarter between the fourth and fifth ribs about 4 inches from the chine bone (fig. 2). This method of hanging the forequarter in the rib section made blocking on the rail very difficult. Those parts of the quarter requiring the most attention in the blocking operation (the area of the chuck, arm, and neck) hung near the floor and were not easily accessible. The greater part of the weight was in the chuck area, which resulted in a tendency of the quarter to swing to and fro during the blocking operation. Furthermore, during the final primal cut separation, it was especially difficult to catch the chuck as it was separated from the rib. For these reasons, almost all meat cutters encountered during the studies failed to utilize the rail for blocking forequarters of beef.

Figure 1.--Hanging a hindquarter of beef on an overhead meat rail--conventional method.

Figure 2.--Hanging a forequarter of beef on an overhead meat rail--conventional method.

Improved method

In order to improve the operation of blocking the forequarter, a method was developed which consisted of hanging the forequarter with the meathook placed in the outside of the chuck at the knucklebone. However, since the forequarter was top-heavy in this position two men were required to unload it from the delivery truck while a third man held the meathook. To simplify this operation, a device called the meathook stabilizer 2/ was developed (fig. 3). This device holds the hook in a rigid position when the quarter is being placed on it and allows the operation to be performed easily by two men (fig. 4).

In operation, the meathook stabilizer is placed on the rail and fastened to each forequarter hook as needed. After the quarter of beef has been placed on this hook, the stabilizer is unfastened, the quarter is rolled along the rail to make room for the next quarter to be unloaded

2/ This term is used for descriptive purposes only and in no way constitutes a trade mark. (For a complete detailed drawing of this device see fig. 17 in the Appendix.)

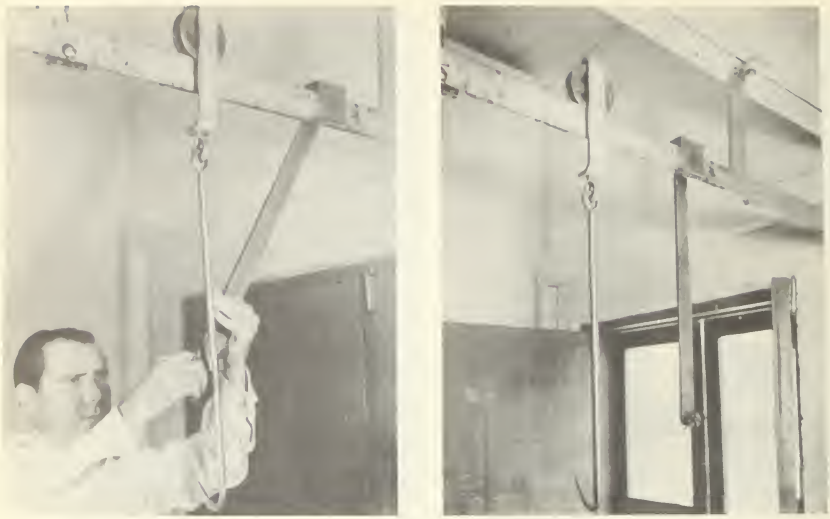


Figure 3.--The meathook stabilizer developed to hold the meathook when receiving forequarters of beef on an overhead rail.

from the delivery truck, and the next hook is positioned on the rail and attached. When the meathook stabilizer was used with the forequarter hung in the chuck by two men, use of the improved method resulted in an increase of 82.1 percent in production over that from receiving by hand. This was a saving of 0.340 man-minute per side over the conventional operation where a two-man crew was used to hang the forequarter in the rib (fig. 5). The meathook stabilizer could also be used by one man to receive both forequarters and hindquarters of beef if the forequarter were hung in the rib. With one man hanging forequarters in the rib, 0.555 man-minute per quarter was saved over the conventional operation which required two men. Since a deliveryman carried the quarters in, and one of the store's personnel was required to unlock the door and check the order, the highest man-hour production for rail receiving was with a two-man team, using the following procedures:

A. When forequarter was hung in the rib:

1. Deliveryman walked to the truck and positioned the forequarter (or hindquarter) on the tail gate of the truck.

Figure 4.--Hanging a forequarter of beef on an overhead rail with the meathook in the chuck--improved method using the meathook stabilizer.

2. Deliveryman carried in the quarter while the store employee positioned the hook and removed the cloth carcass cover from the previous quarter and pushed it along the rail.

3. Store employee held the hook while the deliveryman hung the quarter.

4. When all quarters were hung they were pushed to the scale, four or more at a time, and weighed.

B. When forequarter was hung in the chuck (hindquarter hung in conventional manner as described above):

1. Deliveryman walked to the truck, pre-positioned the forequarter on the tail gate of the truck, and opened the carcass covering to expose the chuck knucklebone.

2. Store employee positioned the hook and stabilizer, removed the carcass covering from the previous forequarter, and pushed it along the rail.

3. Store employee walked to the delivery truck and, together with the deliveryman, carried the forequarter to the rail and hung it in the chuck.

4. Deliveryman carried in a hindquarter while the store employee positioned the hook and removed the carcass covering from the previous quarter and pushed it along the rail.

5. Deliveryman hung the hindquarter while the store employee held the hook.

6. When all quarters were hung, they were pushed to the scale four or more at a time and weighed.

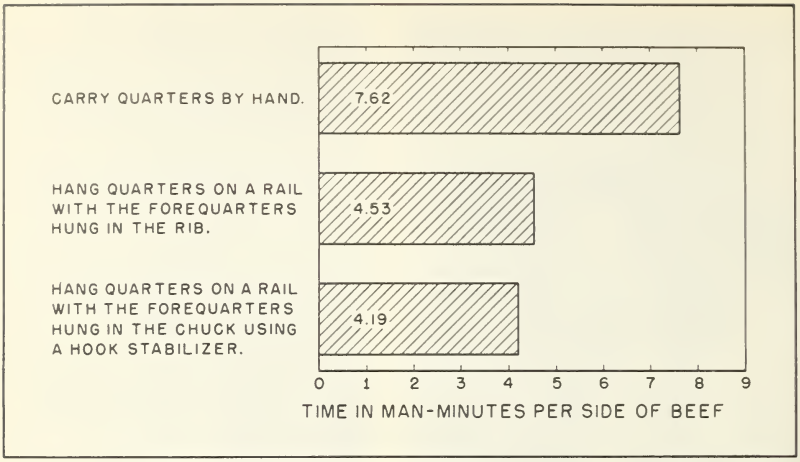

CARRY QUARTERS BY HAND.
7.62
HANG QUARTERS ON A RAIL WITH THE FOREQUARTERS HUNG IN THE RIB.
4.53
HANG QUARTERS ON A RAIL WITH THE FOREQUARTERS HUNG IN THE CHUCK USING A HOOK STABILIZER.
4.19
0 1 2 3 4 5 6 7 8 9
TIME IN MAN-MINUTES PER SIDE OF BEEF

Figure 5.--Comparative time requirements per side to receive beef quarters by hand and with different methods of receiving on a rail.

Receiving Operation for Items Not Received on the Overhead Rail

In receiving without the rail, most of the handling was performed by the delivery personnel. Part of the items commonly handled in this manner required weighing and the rest were received by count. The major differences in time requirements per pound received were owing to the sizes of the meat orders (table 2). Although there were several minor differences for the receiving operation for the two stores, the work performed by the store personnel, such as walking to the door and opening or closing it, required the same time to perform regardless of the size of the meat order; large orders required less time per pound.

Store receiving personnel were able to save considerable double handling by having the deliverymen deliver all or part of an order to the location where the next operation would be performed. For example, they often had preweighed items, which required only pricing, delivered to the pricing table.

In general, the store employees had little control over the time required for receiving. Management could, however, reduce the time requirements by limiting the number, and increasing the size, of the deliveries where practical. Gains could also be made by setting a definite time for

deliveries, thereby making it possible for the employees to plan their work to better advantage.

Table 2.--Average time requirements per pound for receiving specified meat items not received on the overhead rail in two service meat markets

Meat item	Average per order in Store I		Average per order in Store II	
	Pounds	Man-minutes	Pounds	Man-minutes
Pork loins	145	0.029	261	0.022
Fryers	212	.020	393	.007
Hams	-	1/ -	626	.009
Salt meat	-	1/ -	498	.012
All other	93	.052	98	.059

1/ Included in "all other" items.

THE BLOCKING OPERATION

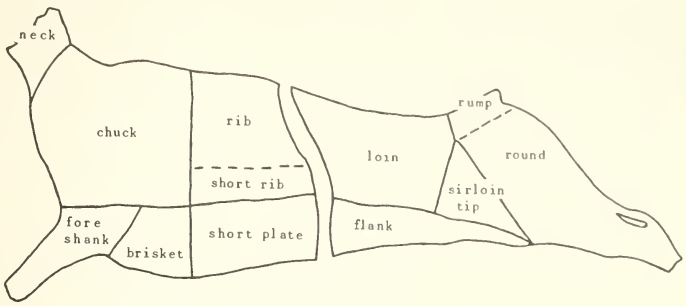
Blocking, as defined in this report, consisted of separating the forequarters and hindquarters of beef into primal or wholesale cuts. The method used in the stores studied is known in the trade as the "Chicago method." Forequarters were converted into the following cuts: Square chuck; rib; short rib; short plate; brisket; foreshank; neck; and trimmings. The hindquarters were converted into loin (short loin plus sirloin), round (which was separated into sirloin tip, rump, and round), flank, kidneys, and trimmings. One of two basic procedures was followed: (1) The quarters were separated into primal cuts on a meat block; or (2) the quarters were separated into primal cuts while suspended by a hook from a meat rail.

Blocking on a Meat Block

In blocking on the block the quarter had to be carried from the receiving area or the cooler, placed on the block, and conditioned. For hindquarters, conditioning involved removing wooden pegs and the spinal cord, trimming off excess fat and discolored or unsalable meat, removing cod fat, trimming off excess kidney fat, and removing the hanging tendon. After conditioning the hindquarters, the operator removed the flank, kidney, and sirloin tip, and separated the loin from the round. In some markets the tail bone and the aitchbone, or rump bone, were removed. Those primal cuts which were not to be immediately broken down into retail cuts were then hung in the cooler. In some stores, a loop of string was tied to each of these cuts, and when the cut was hung in the cooler the hook was inserted through this loop instead of being placed in the meat itself. This procedure prevented damage to the meat, and space was conserved because more than one cut could be hung on a hook. In all studies, the knives were positioned at the side of the block and the hand saw was hung overhead within easy reach.

In blocking the forequarter on the block, the quarter was carried from the receiving area or cooler, placed on the block, and conditioned. For forequarters, conditioning involved removing the wooden pegs, spinal cord, skirt, and membrane, and trimming off excess fat and discolored or unsalable meat. In one store, the neck and then the foreshank were removed. Then the plate, including brisket and short plate, was removed and the rib and chuck were separated (fig. 6). In another store, after the quarter was conditioned, the wing, including rib and short plate, was separated from the chuck and then the foreshank and brisket were separated from the chuck. In most cases, the rib was separated from the short plate and the foreshank from the brisket in the cutting operation. The neck was then removed from the chuck and the various cuts were hung in the cooler or processed into retail cuts (table 3).

Considerable differences were found between markets in the time required to block meat, in part because of differences in methods but



Note: The short plate and rib together are called the *wing*.
The brisket and short plate together are called the *plate*.

Procedure Firm 1

Forequarters

1. Position quarter for blocking
2. Condition the carcass
3. Remove neck
4. Remove fore shank
5. Remove plate and brisket
6. Separate chuck and rib

Hindquarters

1. Position quarter for blocking
2. Condition the carcass
3. Measure and cut flank
4. Remove kidney
5. Remove flank
6. Remove tip
7. Separate loin and round
8. Remove tail and bone rump

Procedure Firm 2

Forequarters

1. Position quarter for blocking
2. Condition the carcass
3. Separate the rib and plate from chuck and brisket
4. Separate rib from plate
5. Cut off neck
6. Cut off fore shank
7. Cut off brisket

Hindquarters

1. Position quarter for blocking
2. Condition the carcass
3. Remove flank
4. Remove kidney
5. Remove tip
6. Remove loin
7. Bone and remove rump

Figure 6.--Outlines of procedures for blocking beef by the Chicago method in two of the stores studied.

primarily because of differences in the amount of work done in the blocking operation. The differences in the time used for conditioning were owing to differences in store policy and in the condition of the beef quarters. The meat cutters in one store did not do so much conditioning, or left some of it to be done in the cutting of retail cuts (table 3). The differences in the time requirements for separation into primal cuts were largely owing to the techniques used. In store No. 2, for instance, the short plate and rib were not separated and neither were the foreshank and brisket. Also, the rump was not removed from the round and the tail bone and the aitchbone were not removed. This accounted for the lower separation times for both forequarters and hindquarters in that store.

Table 3.--Time requirements per quarter for blocking beef quarters on the meat block in two test stores 1/

Beef-blocking operation	Time requirements for--			
	Hindquarter		Forequarter	
	Store 1	Store 2	Store 1	Store 2
	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Positioning of carcass	0.430	0.287	0.805	0.566
Conditioning	2.643	.080	3.532	.475
Separating into primal cuts	2.838	1.910	3.060	1.689
Disposal of primal cuts to cooler	.988	1.059	.949	1.224
Miscellaneous	.504	.200	.264	.317
Total time per quarter	7.403	3.536	8.610	4.271
Personal and fatigue allowance	1.110	.530	1.292	.641
Standard time per quarter	8.513	4.066	9.902	4.912

1/ Appendix table 16 indicates the method used.

One meatcutter was skilled in the use of the power saw in making some of the cuts when blocking the forequarters on the block. Although this procedure required a great deal of lifting of the quarter, it saved time in making cuts and in trimming. In this method, the wing was removed with knife and hand saw, and the arm or chuck was carried to the power saw where the neck, the foreshank, and brisket were removed. 3/ The use of the power saw saved 0.702 man-minute per side (table 4). Procedures other than those tested were the same for both methods of sawing the meat.

3/ The arm or chuck is a trade term referring to the forequarter with the short plate and rib removed.

Table 4.--Comparative time requirements per quarter to make specified cuts in blocking forequarters with the hand saw and with the power saw

Forequarter-blocking operation	Time requirement by--	
	Using hand saw	Using power saw
	Man-minutes	Man-minutes
Remove shank and brisket	0.737	0.178
Remove neck	.392	.140
Position quarter on power saw	-	.201
Total of affected elements	1.129	.519
Personal and fatigue allowance	.170	.078
Standard time of affected elements	1.299	.597

Conventional Rail-Blocking Methods

The conventional method of blocking on the overhead rail involved the same steps as those for blocking on the block except that there was less physical handling of the quarters in the overhead rail method. For hindquarters, the separation of the cuts on the rail was easier than on the block, because they were more accessible on the rail; for forequarters hung in the rib, most of the cuts were more difficult to perform on the rail than on the block because they were less accessible, and because there was a tendency for the quarter to swing to and fro during the blocking operation. The swinging disadvantage was traced to the fact that most of the weight in the forequarter was in the chuck end which hung down near the floor. Each quarter was handled individually, and the cuts were carried back to the cooler one at a time or collected on a table or block and carried back or worked up when the quarter was completely separated into cuts.

No great differences in time to block were noted between blocking on the block and blocking on the rail with conventional methods (table 5). However, considerable lifting and resulting fatigue were eliminated by use of the rail instead of the block. The differences noted in table 5 between the two stores were owing primarily to the amount of conditioning and preparation done.

Improved Rail-Blocking Methods

Several improvements in the rail-blocking methods were developed in order to save handling time and to simplify the operation. Two devices were developed to effect savings, but the greatest time savings were obtained from better organization of the work and the use of better work methods than those employed in conventional methods.

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Table 5.--Comparative time requirements per quarter for blocking beef quarters on the block and on the rail, using conventional methods with the handsaw and with the forequarter hung in the rib, in two test stores 1/

Blocking operation	Time requirement for--							
	Store 1				Store 2			
	Hindquarter		Forequarter		Hindquarter		Forequarter	
	On the block	On the rail 2/	On the block	On the rail	On the block	On the rail	On the block	On the rail
	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Position carcass	0.430	0.408	0.805	0.326	0.287	0.082	0.566	0.217
Conditioning	2.643	2.761	3.532	3.767	.080	.080	.475	.472
Separation into primal cuts.	2.838	2.851	3.060	4.144	1.910	1.552	1.689	1.693
Disposal of primal cuts to cooler.	.988	.988	.949	.732	1.059	1.059	1.224	1.224
Miscellaneous	.504	.399	.264	.386	.200	.281	.317	.262
Total time per quarter	7.403	7.407	8.610	9.355	3.536	3.054	4.271	3.868
Personal and fatigue allowance (15 percent)	1.110	1.111	1.292	1.403	.530	.458	.641	.580
Standard time per quarter	8.513	8.518	9.902	10.758	4.066	3.512	4.912	4.448

1/ Time per quarter shown for *on the block* is the same as that shown in table 3.

2/ For production standard, see Appendix table 16. All production standards shown in this table were constructed in a similar manner.

The knives used in the blocking operation were scored on the back 3, 7, and 10 inches from the tip. This provided a measuring device in the hands of the meat cutter and eliminated the need for the exchange of the knife for a ruler. The calibrated knife aided in training unskilled meat cutters, and it was noted that some skilled cutters used the knife for measuring when they would not have taken the time to exchange the knife for a ruler (fig. 7).

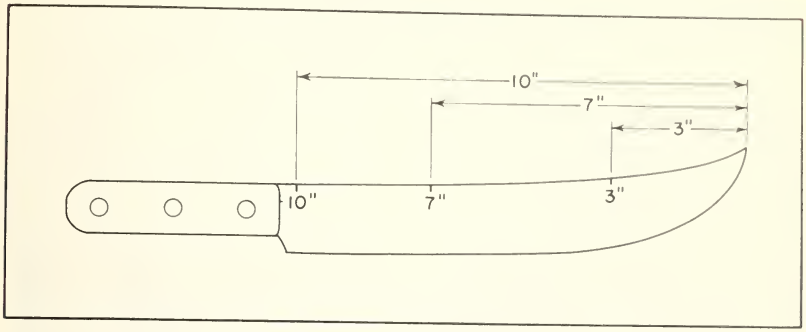

Figure 7.--Calibrated knife for measuring cuts in the blocking of beef quarters.

Another device called the "spinal cord remover" 4/ was developed to remove the spinal cord from both the forequarters and hindquarters (fig. 8). Not all stores removed the spinal cord, but where this was not done the spinal cord tissue tended to deteriorate rapidly and gave an unpleasant appearance to the retail cut of meat. Usually the spinal cord was removed by cutting it loose with a knife and scraping out the crevice with the end of a "steel," normally used for sharpening knives. The time to perform this operation was reduced 65.9 percent by the use of the spinal cord remover (table 6). (Construction details of the spinal cord remover are shown in fig. 18 in the Appendix.)

The hanging of forequarters in the chuck placed most of the cuts to be made in rail blocking at a good working level, and made the separation of rib and chuck comparatively easy because the operator caught the rib instead of the heavier chuck (figs. 9, 10, and 11).

4/ This term is used for descriptive purposes only and in no way constitutes a trade mark.

Figure 8.--The spinal cord remover for cutting out the spinal cord in blocking beef. One illustration shows the remover, and the other shows the remover in use.

Table 6.—Comparative time requirements for removal of the spinal cord with a knife and steel and with the spinal cord remover

Method	Time requirement for—		
	Hindquarter	Forequarter	Side of beef
	Man-minutes	Man-minutes	Man-minutes
Knife and steel	0.517	0.724	1.241
Spinal cord remover	.130	.293	.423
Total time saved	.387	.431	.818

Figure 9.--Removal of the neck from a forequarter of beef hung in the rib, and in the chuck, from the overhead meat rail.

In the improved rail-blocking procedure, all like quarters were processed simultaneously, in contrast with the conventional method of blocking each quarter separately. All the forequarters or all the hindquarters were pushed to the blocking area or were, whenever possible, left in the position in which they were received and weighed, and then blocked immediately to eliminate double handling. All the operations possible to perform with one tool were performed on all like quarters before the tool was laid down. For example, in the conventional method used to remove the foreshank from each quarter, the operator picked up the knife, made the cut, disposed of the knife; picked up the hand saw, made the cut, disposed of the hand saw; picked up the knife, made the cut, and disposed of the shank and knife. This had to be repeated for each quarter. In the improved operation, the operator picked up the knife, made the knife cuts

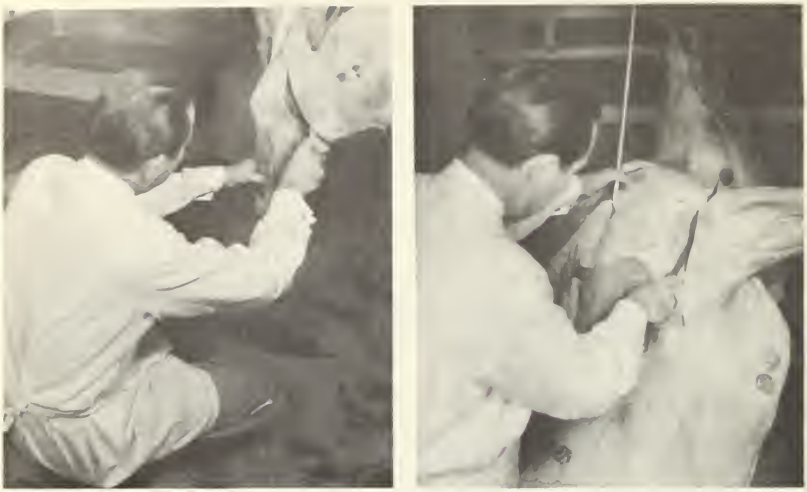

Figure 10.--Removal of the foreshank from forequarter of beef hung in the rib, and in the chuck, from the overhead meat rail.

on the neck, foreshank, and plate of all the forequarters (fig. 12). He then disposed of the knife and made the saw cuts for all quarters and disposed of the saw and necks. He then picked up the knife and removed the foreshanks and plates. All conditioning, trimming, and separation of the initial primal cuts were performed outside the cooler. After the plates and briskets were removed from the forequarters, the saw cut was made through the backbone or chine to begin the separation of the rib from the chuck. The ribs hanging from the chucks were pushed into the cooler where the final separations were made with the knife, and the ribs were placed on the wall hooks.

Likewise, after the hindquarters had been conditioned and trimmed, and flanks removed, the quarters were pushed into the coolers. The sirloin tips were removed and placed on meat hooks and the knife cuts were made to remove the loins from the round. The final cut was made with the saw, separating the round and the loin, and the loins were placed on the wall hooks.

In moving several quarters into the cooler on the rail at one time, considerable walking was eliminated. After the various cuts were placed in the cooler, the rounds and the chucks were left on the hooks until needed, provided there was space in the cooler. It was advantageous to

Figure 11.--Separation of the rib from the chuck with the forequarter of beef hung in the rib, and in the chuck, from the overhead meat rail.

have a double rail in most coolers to make use of this method of storage. When the primal cuts were removed in the cooler rather than in the cutting room, the time to place the cuts on the wall hooks was reduced and considerable walking with heavy loads was eliminated.

The area where the rail-blocking is done should have a table or block located near the rail on which the trimmings and various parts which are boned out can be worked up after the blocking operation. The calibrated knife, hand saw, and the spinal cord remover should be positioned for easy accessibility. If possible the rail-blocking area should be near the cooler and, at the same time, be near the area where the quarters are left at the end of the receiving operation in order to prevent the double handling involved in pushing quarters into and out of the cooler. Also, if quarters could be blocked immediately after they are received there would be less congestion in the cooler. If the rail in the cooler divides by means of a switch into two or more rails, the chucks can be stored on one rail and the rounds on another rail to make it possible for the meat cutter to roll the cut he wants to the cutting room rather than to carry it by hand.

Figure 12.--Six forequarters of beef being blocked successively on the overhead rail.

The improved procedure for blocking forequarters of beef on the meat rail consists of the following:

1. As many forequarters as space permits are positioned on the rail at the blocking area. Several quarters can be pushed along the rail together.

2. "Collars" and dirty or discolored meat at the necks and along the spines are removed from all quarters, as well as the tips of the skirts and the edges of the plates at the navel. 5/ The scraps are placed on a convenient table or block.

3. The collars from all quarters are conditioned at the table with a knife.

4. The skirt membranes are pulled out.

5. The spinal cord remover is obtained and the spinal cords are removed.

6. The calibrated knife is obtained and skirts and navels are removed and knife cuts on necks and foreshanks are made.

7. A hand saw is obtained and the saw cuts for the foreshanks are made and the necks are sawed off and placed on the table.

8. The knife is obtained and the foreshanks are cut off and placed on the table, and the cuts are measured and made for the removal of the plates.

9. The hand saw is obtained and the plates are sawed off and placed on the table.

10. The knife is obtained and a cut is made between the fifth and sixth rib from the chuck end, from the backbone or chine down to 4 inches from the end of the short ribs.

5/ "Collars" are the fat and discolored meat on the lower part of the neck.

11. The hand saw is obtained and a saw cut is made through the backbone or chine, leaving the ribs hanging to the chucks at the short ribs.

12. All the chucks with ribs attached are pushed into the cooler.

13. The knife is obtained and the ribs are removed and hung on wall hooks.

14. If the cooler is not crowded, the chucks are left on the hooks, but if it is necessary the chucks are moved to wall hooks and the hooks returned to the receiving area.

15. The plate, neck, foreshank, and trimmings should now be worked into stew meat, ground beef, and so forth. If this cannot be done immediately, the plate, neck, foreshank, and trimmings should be put into the cooler.

The improved procedure for blocking hindquarters of beef on the meat rail involves the following:

1. As many hindquarters are positioned on the rail at the blocking area as space permits. Several quarters can be pushed along the rail together.

2. The knife is obtained and the flanks of all quarters are cut to the ribs, and the cod fat and kidneys are removed and placed on a convenient table or block.

3. All the hindquarters are conditioned.

4. The spinal cord remover is obtained and the spinal cords are removed.

5. The hand saw is obtained and the flanks are removed and placed on the table.

6. All the hindquarters are pushed into the cooler.

7. The knife is obtained and the sirloin tips are removed and hung on hooks, and knife cuts are made to remove the loins from the rounds.

8. The hand saw is obtained and cuts are made through chine and knucklebones to remove the loins from the rounds, and the loins are rehung on wall hooks.

9. If the cooler is not crowded, the rounds are left on the hooks, but if it is necessary the rounds are moved to wall hooks and the hooks returned to the receiving area.

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10. Kidneys, flanks, and scraps from conditioning should be worked up immediately. If this cannot be done within a short time, the kidneys, flanks, and scraps should be returned to the cooler.

The improved rail-blocking methods resulted in savings of about 2.5 man-minutes per forequarter, and about 2 man-minutes per hindquarter (table 7). These savings were realized by: (1) Hanging the forequarter in the chuck, using the hook stabilizer, instead of the former or conventional method of hanging the forequarter in the rib; (2) using the improved blocking methods listed above; and (3) using the spinal cord remover. Other elements involved in blocking remained the same as those in the conventional method.

Few of the improved rail-blocking methods could be applied to blocking on the block.

Table 7.--Comparative man-minute requirements for former or conventional and improved methods of blocking beef on the overhead rail in one test store

Blocking operation	Time requirement for--				
	Hindquarter hung in the shank loop		Forequarter hung in the rib		Forequarter hung in the chuck
	Former 1/	Improved	Former	Improved	Improved
	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Positioning of carcass	0.408	0.159	0.326	0.147	0.147
Conditioning	2.761	2.464	3.767	3.380	3.382
Separation into primal cuts	2.851	2.376	4.144	3.218	2.699
Disposal of primal cuts to cooler	.988	.155	.732	.313	.313
Miscellaneous	.399	.367	.386	.402	.402
Total time per quarter	7.407	5.521	9.355	7.460	6.943
Personal and fatigue allowance (15 percent)	1.111	.828	1.403	1.119	1.041
Standard time per quarter	8.518	6.349	10.758	8.579	7.984

1/ Production standard shown in table 17 in the Appendix. All production standards shown in this table were constructed in a similar manner.

THE CUTTING OPERATION

As defined in this report, the cutting operation is the dividing of wholesale cuts of meat into retail cuts. This involves preparation for cutting (removal from original container and pretrimming of wholesale cut), separation into retail cuts, boning and trimming of the retail cuts, removing bone and fat smear from those items cut on the power saw, panning the product, and all walking and handling necessary for obtaining the wholesale cut at the beginning and disposing of the retail cut at the end of the operation. It includes preparing retail cuts from beef, veal, and lamb carcasses, boning and trimming for stew beef and ground beef, cutting up pork loins, fryers, slab salt meat, liver, and other such items, and slicing luncheon meats.

The cutting operation required about 25 to 30 percent of the total market time in the two self-service markets studied and about 15 to 21 percent in the two service markets (see table 1).

The separation into retail cuts, boning, and trimming of cuts required about two-thirds of the cutting operation time in all markets (table 8). The percentage of the time used for cleaning and scraping the meat varied from store to store, primarily with the degree of thoroughness of the meat cutters in cleaning the meat.

Table 8.--Percentages of total elemental time per package for different operations of cutting meat in four stores 1/

Operation	Self-service		Service	
	Store 1	Store 2	Store 3	Store 4
	Percent	Percent	Percent	Percent
Preparation for cutting, separation into retail cuts, boning, and trimming	67.0	63.2	59.5	67.8
Cleaning and scraping	4.2	11.1	6.3	1.6
Product handling and panning	21.7	15.4	18.6	16.5
Pan and paper handling	2.4	2.5	5.8	5.8
Label handling	-	4.1	-	-
Miscellaneous	4.7	3.7	9.8	8.3
Total	100.0	100.0	100.0	100.0

1/ For elemental time per package of cutting by items, see tables 18, 19, 20, and 21 in the Appendix.

Product handling and panning required 15 to 20 percent of the time in all markets. Pan and paper handling required more time in the service markets than in self-service markets.

Label handling in one self-service store involved getting, coding, and placing the appropriate labels on each pan of meat before delivering it to the wrappers in order to insure correct labeling and coding of the meat. In the other self-service store the label handling occurred in the packaging operation.

The total elemental time in man-minutes per package for the cutting operation in four stores was as follows:

Store	Man-minutes
Self-service store No. 1 (Firm I). . . .	0.903
Self-service store No. 2 (Firm II) . . .	.470
Service store No. 3 (Firm I)	.890
Service store No. 4 (Firm II)	.455

The time required for the entire cutting operation was about the same for the service and self-service stores belonging to the same company, but the stores of one company required almost twice as long per package as the time required by stores belonging to the other company. This requirement would indicate that the practices of the company had more influence on cutting time than did the type of store.

In order to eliminate some of the effects due to different items, package weights, and volume of sales, comparisons were made on a pound basis for the 15 items which were comparable, using the same weekly item sales for all stores. The resulting comparable times were: Self-service markets, Store 1, 0.820; Store 2, 0.616; and service markets, Store 3, 0.805; Store 4, 0.400.

Preparation for Cutting

Preparation for cutting involved obtaining the meat, removing it from its container or wrapper when so delivered, and doing the necessary trimming preparatory to separation into retail cuts. For beef and veal loins, the chine bone and tail were removed. For chucks, rounds, and sirloin tips, dark or bloody meat and fat were removed. Pretrimming of wholesale cuts is most important with beef loins and ribs. By pretrimming the wholesale cut, most of the trimming necessary on the individual cuts can be eliminated. For instance, trimming the edge of the chine bone of the short loin on the power saw is much faster than trimming this bone from each individual T-bone steak.

In one market the short loin was separated into T-bone steaks on the saw and then for each steak the chine bone was trimmed, the excess fat was removed, and the tail of the steak was trimmed off.

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By trimming the chine bone and removing the tail of the loin on the power saw and trimming off excess fat with a knife before separating the loin into steaks, 0.111 man-minute per steak was saved. This saving was obtained when using U. S. Commercial or U. S. Good grades of beef. It is more difficult to pretrim the higher grades of beef because of the additional fat on the beef. Pretrimming loins of Choice and Prime beef did not save time.

In separating beef ribs into steaks the conventional method was to saw the rib into steaks, then trim off the ends of each rib on the power saw and make two saw cuts on the rib of each steak to permit the tail of the steak to fold in. The excess fat was then trimmed off with a knife. It was found that the excess rib and chine bone could be pretrimmed and the two saw cuts made to fold the tail of the loin before the rib was cut into steaks. When the steaks were thus handled the only remaining operation was to trim off the excess fat with a knife and clean the steak. This method of pretrimming the rib resulted in a saving of 0.143 man-minute per steak.

Separation into Retail Cuts; Boning; and Trimming

Separation into retail cuts involves converting wholesale cuts into retail cuts. This function was usually performed with a large steak knife on boneless meat and a knife plus a hand saw, or the power saw, on cuts having bones. Boning is the separation of the meat from the bone, and it was done with a small-bladed boning knife. Trimming involves cutting off pieces of meat or fat not wanted on a particular cut or the trimming out of stew beef meat from neck or shank meat. This was usually done with a boning knife. Occasionally the power saw was used to take off sharp edges of bones, and some meat cutters use a cleaver to trim fat from T-bone steaks or sirloin steaks. The major use of the cleaver was on pork products or fryers.

In order to facilitate the separation of hams into retail cuts, a handsaw blade was developed which was made with one-third of the length having teeth and the other two-thirds being sharpened as a knife (fig. 13). This device proved to be faster than the separate handsaw and knife when cutting hams because it could be used for the whole cut without exchanging tools. It also proved to be faster than the power saw because the latter left smear on the meat which had to be removed by hand. The saw-knife device required 30.7 percent less time than did the separate handsaw and knife and 43.2 percent less time than that required by the power saw for the regular elements affected in the cutting operation on hams (table 9).

Additional studies were made on the use of the saw-knife device in cutting lamb, veal, and pork chops. It was found that the device was not advantageous for those items in comparison with the time required for cutting them by use of the steak knife and cleaver.

Figure 13.--Section of special combination saw-knife blade for use in standard handsaw frame for cutting hams.

It was noted that a number of operators preferred to cut fresh beef, veal, lamb, and pork items by hand (using the steak knife and the handsaw) instead of on the power saw. This preference was based on two opinions: (1) That more time per item was required when using the power saw because bone and fat smear had to be removed from each retail cut of meat as a separate operation; and (2) a cleaner, more salable cut was obtained when the meat was cut by hand in comparison with the same item cut on the power saw with the smear later removed by hand.

Studies were made of the cutting operation for five representative commodities when cut on the power saw and when cut by hand. All elements necessary to prepare the retail cut for packaging were studied, including the removal of the smear from those items cut on the power saw. For these five commodities, the time required was reduced by 31.5 percent when the power saw was used (table 10).

Table 9.--Comparative time requirements for the regular elements 1/ affected in separating whole hams using separate handsaw and knife, combination handsaw and knife, and power saw

Element	Man-minute requirement per ham using--		
	Separate handsaw and knife	Combination handsaw and knife	Power saw
	Man-minutes	Man-minutes	Man-minutes
Obtain knife and cut to bone and dispose of knife	0.170	-	-
Obtain handsaw and cut bone and dispose of saw	.145	-	-
Obtain knife and finish cut and dispose of knife	.082	-	-
Obtain saw-knife and cut ham and dispose of saw-knife	-	0.275	-
Position ham at power saw	-	-	0.070
Cut ham on power saw and place on cutting table	-	-	.064
Wipe bone and fat smear from ham	-	-	.350
Total (regular elements only)	.397	.275	.484

1/ Work methods for each function were separated into component parts called elements.

Table 10.--Comparative cutting time requirements per piece of meat from using the handsaw and knife and from using the power saw for cutting five retail cuts of meat in one store

Retail cut of meat	Time per piece using handsaw and knife	Time per piece using the power saw	Time saved in using the power saw
	Man-minutes	Man-minutes	Percent
T-bone steak	0.609	0.255	58.1
Sirloin steak	.931	.505	45.8
Chuck roast	.683	.471	31.0
Pork chops	.115	.105	8.7
Center cut ham slices	.343	.166	51.6
Weighted average 1/	.295	.182	31.5

1/ Based on the frequency with which the various items occurred in the market.

No statistical measurement was attempted in order to compare the appearance or salability of items cut by hand and on the power saw. However, observation and experience with these two methods of cutting over a period of time indicated no significant difference when those items cut on the power saw were thoroughly cleaned of bone and fat smear.

Cleaning the Retail Cuts

Two methods were used to clean fat and bone smear from retail cuts of meat. Some operators used a rag or towel to wipe the smear away but most operators had some sort of device to scrape the surface of the meat. Sometimes a knife was used but one of the most common devices was a bandsaw blade bent back and having the ends taped together to form a handle. Commercially made devices of this sort were also available. Occasionally an operator cleaned pork chops, chuck roasts, rib roasts, boiling beef, or short ribs with a rag or towel, usually because the operator felt that a scraper would not work so well. In some stores some cuts were not cleaned at all even when there was considerable smear on the cuts. The most common cuts not cleaned were pork chops and ham slices.

In some cases both sides of the cut were cleaned but some operators cleaned only the side exposed when the package was displayed. The reasons given for this were: (1) The other side of the cut is partially cleaned by its contact with the meat backing board or tray; and (2) the unseen side of the cut does not affect the sale.

During the study a device was developed to remove the bone and fat smear from the other surface of the meat as the meat was being cut. It eliminated entirely the need for a separate wiping or scraping of one side of the retail cut. This device, which is called a "smear remover," 6/ is attached to the space guide which regulates the thickness of the cut and guides the meat through the saw (fig. 14). The smear remover consists of a series of stainless steel leaf-type springs each of which has one or more holes that are used to remove the smear as the outer surface of the meat passes over the spring. The holes for horizontally successive rows of springs are offset to permit wiping the entire outer surface of the cut. Each individual spring operates separately from a vertical post to which it is attached. The purpose of the individual leaf-type springs is to make it possible to collect the smear from around bones which protrude slightly from the meat.

When the smear remover was used for a considerable volume of meat it was necessary to empty the collected fat and bone smear from behind the leaf-type springs two or three times a day. This was done by lifting the

6/ This term is used for descriptive purposes only and in no way constitutes a trade mark. For a complete detailed construction drawing of this device see Appendix figure 20.

Figure 14.--Smear remover space guide attached to the power saw.

smear remover from the space guide and shaking it. When stainless steel was used for the springs the device could be easily cleaned when no longer needed for the day by holding it under running hot water.

In order for the smear remover to work properly, it was necessary for the operator to hold the meat firmly against the guide so that all the surface of the cut was rubbed against the device. For many cuts this took no more time than without the smear remover. When the smear remover was properly used the meat was cleaner than when the scraper or rag was used, and many operators expressed the opinion that the meat was as clean as it would be if it were cut with a knife. Most operators did not clean the reverse side of the meat when using the smear remover, but displayed the meat with the clean side up. However, considerable time was saved even when the reverse side was cleaned in the conventional manner with a rag or scraper (fig. 15).

Tests made in two stores indicated that the smear remover increased production 20 to 30 percent on the items that required cleaning (tables 11 and 12). The savings in labor in a week in these two markets were 4.5 and 3.0 man-hours, respectively.

In several markets, when the operators changed from cleaning two sides of the meat by hand to cleaning only one side with the smear remover, the cutting time was reduced by 50 percent on these cuts of meat. Early indications are that this device will cost from $60 to $75 and should soon be on the open market. 7/

7/ The smear remover was developed jointly by employees of the Marketing and Facilities Research Branch, PMA, USDA; and the Kroger Company, Colonial Stores Co., and the Southern Saw Co. of Atlanta, Ga. These developers have made their rights in this invention available to the public on a free use basis.

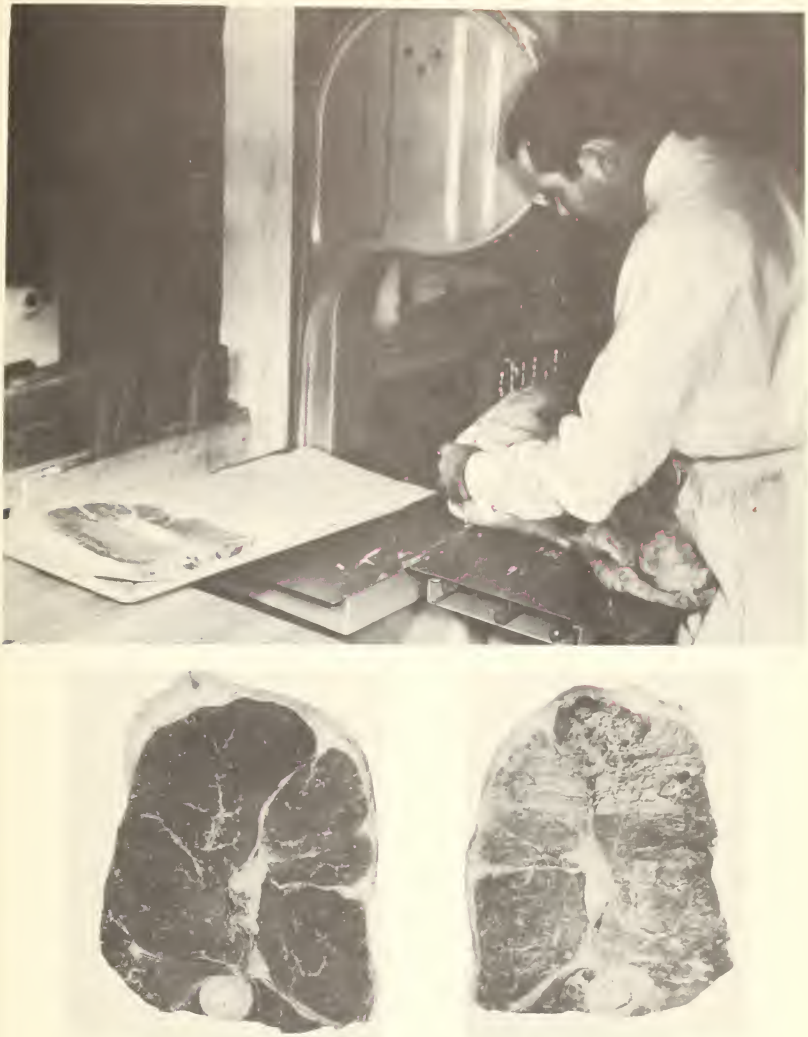

Figure 15.--Smear remover for power meat saws in use. The retail cuts, being placed directly on a pan, showing cuts with and without the smear removed.

Table 11.—Effect on productivity with smear remover attached to a power saw for cutting meat in Store No. 1

Retail cut of meat	Standard time in man-minutes per package for all elements in cutting operation		Increase in production from use of smear remover
	Conventional operation without smear remover	Conventional operation with smear remover	
	Man-minutes	Man-minutes	Percent
Sirloin steak	1.149	1.021	12.5
T-bone steak	1/ 1.027	.934	10.0
Chuck roast	.935	.895	4.5
Full round steak	.897	.614	46.1
Rib steak (bone in)	.782	.692	13.0
Lamb chops	.843	.582	44.8
Veal chops	.851	.723	17.7
Veal sirloin	.761	.634	20.0
Center cut ham slices	.524	.472	11.0
Center cut pork chops	.865	.631	37.1
End cut pork chops	.769	.536	43.5
Weighted average 2/	.870	.716	3/ 21.5

1/ See table 17 in the Appendix for details of production standard. Other standards shown in table were constructed in similar manner.

2/ Based on the actual frequency with which the various cuts occurred in the store.

3/ This represents a saving of 0.154 man-minute per package for the above cuts. In this store this represented a saving of 4.5 man-hours per week.

Table 12.—Effect on productivity with smear remover attached to a power saw for cutting meat in Store No. 2

Retail cut of meat	Standard time in man-minutes per package for all elements in cutting operation 1/		Increase in production from use of smear remover
	Conventional operation without smear remover	Conventional operation with smear remover	
	Man-minutes	Man-minutes	Percent
T-bone steak	0.483	0.363	33.1
Sirloin steak	.563	.440	27.1
Rib steak	.364	.312	16.4
Chuck roast	.542	.429	26.1
Pork chops	.666	.473	41.1
Brisket beef	.220	.163	34.8
Center cut ham slices	.225	.169	33.0
Weighted average 2/	.444	.335	3/ 32.5

1/ Appendix table 17 shows details of the method used.

2/ Based on the frequency with which the various cuts occurred in the store.

3/ This represents a saving of 0.109 man-minute per package for the above items. In this store this represented a savings of 3.04 man-hours per week.

Panning the Product and Pan and Paper Handling

Considerable time is spent in placing the meat on the pan, positioning peach paper, 8/ and handling pans and paper. If possible, the handling and panning of the meat product should be combined with another operation. When the smear remover was used on the power saw, the pans were placed on the saw platform to the left of the blade and many cuts were panned as cut.

An example of savings available from the proper location of packaging materials was shown in one of the test stores where the panning operation was improved by placing the empty pan storage in a rack at the work place instead of on a table just outside the cutting room door. This improvement resulted in a saving of 0.208 man-minute per pan or 38 man-minutes per week (table 13).

Table 13.--Comparative time requirements to obtain pan and position it for meat-cutting operation when the pans are stored in a rack at the work area and when they are stored on a table outside the cutting room

Meat-cutting operation	Time requirement with--	
	Pans on table outside cutting room	Pans in a rack at work place
	Man-minutes	Man-minutes
Obtain and position pan	0.245	0.064
Personal and fatigue allowance (15 percent)	.037	.010
Standard time per pan	.282	.074
Saving in man-minutes per pan	-	.208

In the same store improvements were made in the handling of peach paper. Formerly the paper was torn from an 18-inch roll to fit a 12" x 30" pan. This required two pieces of paper 12" x 18". These two pieces of paper were placed on the pan with a 6-inch overlap. An improvement was made by placing sheeted 12" x 30" peach paper in a rack at the work place. This improvement provided a 16.7 percent saving in paper (amounting to $4 a week) and saved an hour and three-quarters of labor per week in an average-sized market in the area studied (table 14).

8/ Peach paper is a type of butcher paper which is specially treated to preserve freshness in meat.

Table 14.--Comparative time requirements to handle peach paper in panning meat at the cutting operation when the paper is torn from an 18-inch roll and when it is provided presheeted to the correct sizes at the workplace

Paper for panning meat	Time requirement for—	
	Paper provided in 18-inch rolls	Paper presheeted to correct size
	Man-minutes	Man-minutes
Tear off two sheets	0.120	-
Position on pan or meat	.104	-
Obtain and position paper on pan or meat	-	0.062
Total time per layer of paper	.224	.062
Personal and fatigue allowance (15 percent)	.034	.009
Standard time per layer	.258	.071

Workplace Arrangement for Cutting

In the design and operation of the workplace arrangement for a meat cutter, the following principles should be applied in order to achieve a smoother flow of products and to reduce the handling time: 9/

1. An adequate, compact working area for the operator should be provided with all the necessary materials, product, and equipment within easy reach.

2. The point of product disposal, from the cutting operation to the packaging operation, should be adjacent to the meat cutter's workplace.

3. Most work tables and blocks in the stores studied were 34 inches in height. This height is satisfactory for blocking and for preparation for cutting, but for all other cutting operations the tables and blocks should be higher. Tables 36 inches high were found to be satisfactory for the average worker.

9/ Motion and Time Study. p. 233. By Dr. Ralph M. Barnes (John Wiley and Sons, Inc., New York, London). (1949.)

4. All cooler floors and all walkways should be at floor level so that stepping up and down with heavy loads is unnecessary; also, so that push carts or similar wheeled devices can be used.

5. Doors should open in the direction of the movement of the meat products. Where the flow is in both directions, the doors should be swinging. Cooler doors should open out and should be large enough and high enough to permit moving bulky loads through them.

6. Bone, trimming, and fat barrels should be placed on frames with large casters so that they can be moved closer to the work area, when boning and trimming is being done, and rolled into the cooler easily.

7. One of the most common faults of meat markets is that of cluttering up the aisles and walkways. The cutting room should be arranged so as to eliminate as much walking as possible and the walk areas should be kept clear.

In most self-service markets, and in many service markets, poor organization for handling special orders for customers caused considerable disruption in the cutting operation. In many markets there was poor access from the counter to the cutting room. When special orders came in it was usually necessary for one of the meat cutters to interrupt his work in order to handle it. In one market the locations of a small grinder, a steak cuber, and a slicer on a table near the entrance to the display area eliminated much of the confusion of special orders. The counterman was able to cube and grind packaged meat without disturbing the meat cutters. In addition, a walkway was provided to the cutting room and cooler from the display area for handling other special orders. A scale placed convenient to the cutting area proved useful also in handling cuts where special weights were requested.

The switches on the meat grinders in the markets studied were poorly positioned. The use of a foot- or knee-controlled switch would appear appropriate. A foot pedal release for opening cooler doors so that the operator could enter the cooler when carrying something with both hands should also be a definite improvement.

A workplace arrangement was developed for meat cutters on the basis of the seven principles listed above. The optimum and maximum work areas for the average operator were plotted and all tools, work areas, product storage areas, and disposal points were arranged into these work areas (fig. 16). Space was provided for the power saw or meat choppers. The size of the work areas was determined from measurements of the different cuts of meat. (Construction details for the work table are shown in figure 19 in the Appendix.)

In the improved cutting workplace arrangement, the empty pans were positioned at table top level adjacent to the left side of the cutting table. Here they were near the point where each pan would be used during

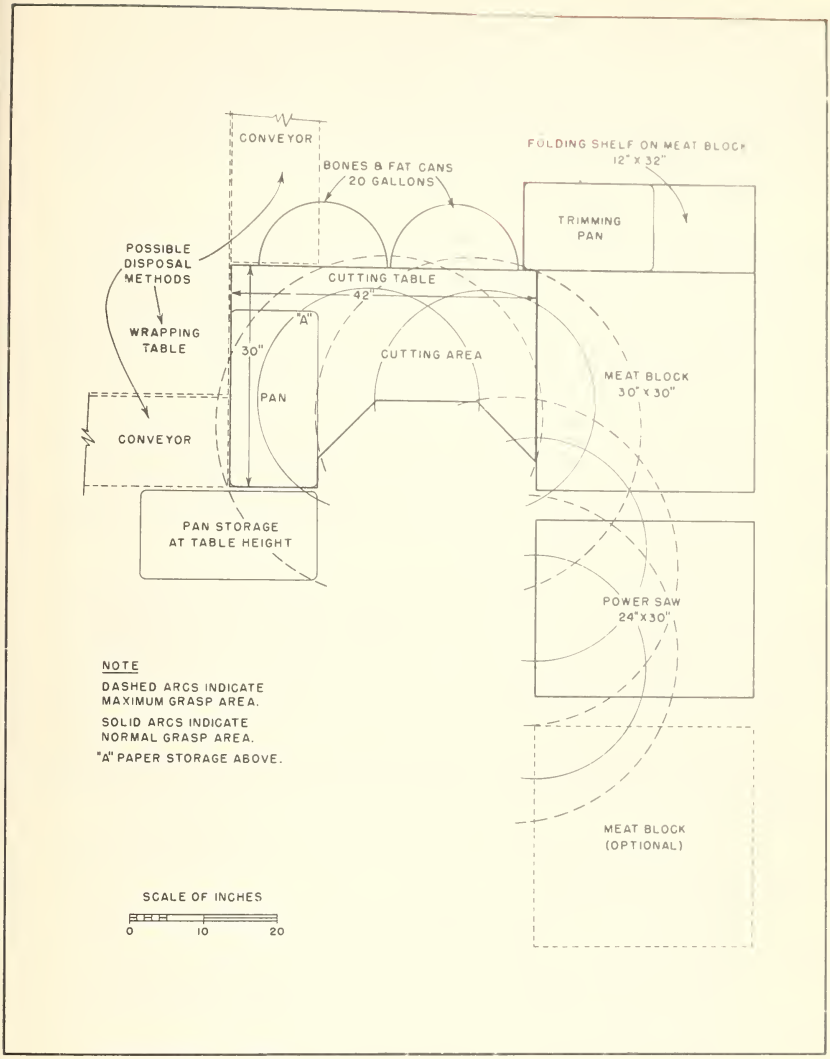

Figure 16.--Meat cutting table showing how the principles of good workplace arrangement were incorporated.

the cutting operation. The conventional pan location was beneath the cutting table, several feet from the point at which the pans were to be used. Peach paper, previously stored beneath the cutting table, was suspended from a hook in the ceiling directly over the pans. This was accomplished by inserting (using a needle) a string through one corner of the package of paper and tying this string to a hook above the cutting table, allowing the bottom portion of the paper to hang 18 inches above the cutting table. Peach paper was obtained by pulling a sheet directly down on the positioned meat pan.

The power saw was placed at right angles to the cutting table in order to reduce the walking distance from the saw to the cutting table. The forward edge of the table was 18 inches from the operator's working position, so that trimmings could be easily dropped directly into the disposal barrels, which were placed along the forward edge of the cutting table. These disposal barrels were placed on casters to allow them to be rolled to this position under the table and to eliminate the necessity for lifting or carrying the barrels from one place to another.

The cutting table was recessed so that more working area could be within normal reach of the operator. The meat block was placed to the right of the table and served as: (1) An accumulation area for those items cut on the power saw; and (2) a working area for those items cut with a cleaver. The improved cutting table placed beside the block increased the effective working area.

It is important to note that the location of pans and peach paper and the positioning of the power saw at right angles to the cutting table could be included in a cutting operation without the additional expense of building new cutting tables. If the cleaver is not required at this work station, the same result can be obtained by recessing a standard 30" x 72" cutting table and increasing the height to 36 inches.

When this workplace arrangement was installed in an average-sized store located in the Southeast, it required only 75 percent as much space as before, and it provided savings from the several improvements as follows:

1. Relocation of pans from under the table to table level saved 40.8 man-minutes per week.

2. Relocation of paper from under the table to above the table saved 88.5 man-minutes per week.

3. Relocation of the power saw to obtain L-shaped workplace arrangement saved 20.4 man-minutes per week.

4. Location of bone, fat, and trimming barrels to a point 15 inches in front of the operator saved 40.8 man-minutes per week.

5. The providing of a "cut-out" in the table to increase the usable workspace saved 61.2 man-minutes per week.

Total savings per week amounted to 251.7 man-minutes, or about 4.2 hours. These savings of 4.2 hours per week represented a 10-percent increase in production for the cutting operation in the test store.

OVER-ALL EFFECT OF IMPROVEMENTS IN THE RECEIVING, BLOCKING, AND CUTTING OPERATIONS IN FOUR STORES

In two stores which had meat rails, the following improvements were made in the receiving, blocking, and cutting operations: (1) Forequarters of beef were hung in the chuck; (2) the hook stabilizer was used; (3) improved rail-receiving and rail-blocking methods were used; (4) the spinal cord remover was used; (5) the saw-knife combination was used on hams; (6) the smear remover was used to wipe one side of the meat whereas formerly both sides were wiped by hand; and (7) the improved cutting workplace arrangement was installed, including the installation of pan storage at table level and storage of peach paper overhead. These improvements resulted in a saving of 14.1 man-hours a week in one store, and 28.4 man-hours a week in the other, or an increase in productivity of 36.3 percent and 38.9 percent respectively. Difference in volume was the primary cause for the difference in time saved in the two stores.

In a third store, an overhead meat rail was installed in addition to the same improvements made in the first and second stores. The rail, added to the other improvements, created a saving of 16.0 man-hours per week in the receiving, blocking, and cutting operations in this store. This saving was equivalent to an increase in productivity of 36.3 percent.

In the fourth store, no changes were made in the receiving and blocking operations, but the following improvements were installed in the cutting operation: (1) The power saw was used instead of the handsaw and knife for cutting T-bone steaks, sirloin steaks, rib steaks, chuck roasts, ham slices, and pork chops; (2) short loins and ribs were pre-trimmed before they were cut on the power saw into retail cuts; (3) the smear remover was installed on the power saw to clean the one side of the meat normally cleaned in the store; (4) the pans were moved from a rack outside the cutting room to a position beneath the cutting table; and (5) presheeted peach paper was installed at the cutting table in place of roll paper. These improvements saved 8.5 man-hours per week and increased the productivity for the combined receiving, blocking, and cutting operations by 26.6 percent. In addition, a 16.7-percent reduction in peach paper requirements produced a saving of $4 per week.

METHODOLOGY

The methods and equipment used in a number of stores of several different food chains in various parts of the country were examined before detailed studies were made. A close examination was made of the operations in 52 stores of three companies in the southeastern part of the country and 26 stores were selected for detailed studies. Studies were made in meat markets in 4 of these stores in order to determine the labor required to perform the various service and self-service operations. Two of the markets were considered as self-service; one had 100 percent self-service for meats, the other had 90 percent self-service and also sold fresh fish and poultry over a service counter. The other two stores were considered service markets: One was 55 percent self-service with all red meats except some pork roasts and offal and a little poultry sold by the service method; the other was a 50-percent self-service market, all red meats, poultry, and seafood being sold with service. Personnel in each store was timed for one week and the total time required to perform the various store functions was determined. From these studies it was determined that packaging materials would be analyzed and that the functions of receiving, blocking, cutting, packaging and pricing, display, and customer service would be studied in detail. This publication covers receiving, blocking, and cutting of meats for both service and self-service markets.

These market functions were studied in 11 selected stores by analyzing and testing various methods, materials, equipment, and layouts for possible reductions in labor and materials costs.

Work methods for each function were separated into component parts called elements. With the stop watch, each element was timed for a sufficient number of cycles to obtain a statistically reliable average time for each element for each operator studied. These times were rated in accordance with standard methods. 10/ The rating factor was applied to the average time for each element studied in order to convert actual performance of the operator studied to expected performance by the average operator using the same method. This in effect removed variation due to the speed of the operator. Skill was not considered to be a factor in individual performance; it was defined for the purposes of this study as the ability of the operator to follow a given motion pattern without hesitation. No operator was timed who did not have this ability. A fatigue and personal allowance factor of 15 percent was applied to the various elements for each study. 11/ Avoidable delays were excluded from each time study but

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10/ Ralph Presgrave. THE DYNAMICS OF TIME STUDY. (McGraw-Hill Publishing Co., New York, London.) (1945.)

11/ The selection of the 15-percent allowance was based on the Personal and Fatigue Allowance Table, p. 370, of MOTION AND TIME STUDY. By Dr. Ralph M. Barnes. (John Wiley & Sons, New York.) (1949.)

all productive elements, which the operator performed, and any unavoidable delay in a given operation were included. Set-up and clean-up times were not included except where these functions took place during the performance of an operation being studied, as, for example, cleaning the scale platform while weighing.

The basic unit of measurement in all studies in this report was the package. Those elements which occurred less frequently than once for each package were weighted on the basis of percent occurrence. For example, in a time standard some elements may be included which occur for each pan of merchandise handled. These elements relating to the pan might take 0.632 man-minute but would occur once per pan. The elements would then be included in the standard for T-bone steak as 0.632 times 12.2 percent (average of 8.2 T-bones per pan) equals 0.077 man-minute per package. The weighted average elemental times were added together to obtain the total time for each operation. Fifteen percent of this time was added for personal and fatigue allowance in order to obtain the standard time per item. Personal and fatigue time represented the personal time required by the employee during the working day plus the rests needed to achieve continued production expected of the average worker. Standard time divided into 60 minutes per hour gave production in items per man-hour. In order to indicate the method of developing productivity figures, examples of receiving, blocking, and cutting standards are shown in tables 15 to 21. In order to develop a complete standard for a given retail cut of beef, it was necessary to apportion the time required per quarter of beef for receiving and blocking to the time per retail cut. Detailed procedure is shown in tables 15, 16, and 17.

The various methods, materials, equipment, and layouts encountered and those developed during the study were time-studied in the above-described manner and the standard times were obtained to develop comparative productivity data. These productivity data, plus cost information, were used to evaluate the various methods, materials, equipment, and layouts.

APPENDIX

Table 15.--Production standard in one store for receiving sides of beef on the rail with the forequarters hung in the rib 1/

Element	Basic elemental time	Frequency of element occurring per side	Weighted elemental time per side
	Man-minutes	Percent	Man-minutes
Clear work space	2.790	11.8	0.329
Check invoice	.370	6.2	.023
Position hooks on rail	.048	200.0	.096
Roll hooks to door	.134	25.0	.034
Lay hooks aside	.130	12.5	.016
Reposition hooks on rail	.084	137.5	.116
Hold hooks to receive forequarter and roll along rail.	.138	100.0	.138
Hold hooks to receive hindquarter and roll along rail.	.171	100.0	.171
Delay for 2-man team	.368	156.2	.575
Roll fronts to weigh station	1.152	25.0	.288
Roll hinds to weigh station.	.545	25.0	.136
Adjust scale and set	.510	6.2	.032
Weigh forequarter	.750	25.0	.188
Weigh hindquarter	.780	25.0	.195
Check weights and sign invoice	1.324	31.2	.413
Obtain stamp and stamp invoice	.539	6.2	.033
Push hindquarter off scale	.080	12.5	.010
Push forequarter off scale	.230	12.5	.029
Dispose invoice to clip	.194	18.8	.036
Return invoice to driver	.100	6.2	.006
Lock door and return to scale.	.512	31.2	.160
Push forequarter to temporary storage.	.660	25.0	.165
Push hindquarter to temporary storage.	.477	25.0	.119
Remove cover from forequarter.	.243	100.0	.243
Remove cover from hindquarter.	.273	100.0	.273
Clear area and dispose of covers	.900	12.5	.112
Total man-minutes per side			3.936
Personal and fatigue allowance (15 percent)			.590
Standard man-minutes per side			4.526

1/ Receiving time when converted to the retail cut for T-bone steak is based on the salable weights of beef carcasses, so the standard is for a side of beef. To calculate for T-bone steak: The average side of beef in this market weighed 300 pounds, of which 77.7 percent was salable meat. This gives 233 pounds of salable meat per side. 4.526 man-minutes divided by 233 gives 0.019 man-minute per pound. The average T-bone steak weighed 0.94 pound per package. 0.019 times 0.94 equals 0.018 man-minute per package.

Table 16.--Production standard in one store for blocking hindquarters of beef hung on the rail 1/

Element	Basic elemental time	Frequency element occurring per quarter	Weighted elemental time per quarter
	Man-minutes	Percent	Man-minutes
Obtain barrel from back room	0.581	2.7	0.016
Obtain barrel from back room and clean	1.140	1.4	.016
Position quarter at blocking station	.270	100.0	.270
Sharpen knife on stone	6.593	1.4	.092
Steel knife	.107	31.1	.033
Change handsaw blade	1.450	1.4	.020
Condition	.718	100.0	.718
Remove spinal cord	.517	100.0	.517
Remove pegs	.101	56.8	.057
Remove kidney only	.344	60.0	.206
Remove kidney and hanging tender	.233	40.0	.093
Make knife cut on flank	.438	100.0	.438
Saw off flank and to block	.564	100.0	.564
Remove tip and to block	.755	100.0	.755
Separate loin and round	.795	100.0	.795
Remove tail bone	.533	100.0	.533
Remove aitchbone	.936	100.0	.936
Dispose round to block	.138	100.0	.138
Dispose of loin to cooler	.315	100.0	.315
Dispose of tip to cooler	.226	100.0	.226
Dispose of round to cooler	.447	100.0	.447
Rearrange cooler	.285	23.0	.066
Dispose hooks to floor at scale	.073	100.0	.073
Dispose hooks to back room	.062	100.0	.062
Clean block	.268	7.8	.021
Total man-minutes per quarter			7.407
Personal and fatigue allowance (15 percent)			1.111
Standard man-minutes per quarter			8.518

1/ Blocking time when converted to the retail cut, as for T-bone steak, is based on the salable weights of beef carcasses, so the standard is for a side of beef. To calculate for T-bone steak: The average side of beef weighed 300 pounds, of which 77.7 percent was salable meat. This gives 233 pounds of salable meat per side. The average time per side for blocking was 19.276 man-minutes. This time divided by 233 amounts to 0.083 man-minute per salable pound of meat. The average T-bone steak weighed 0.94 pound. Thus, blocking required 0.078 man-minute per T-bone steak.

Table 17.--Production standard for cutting T-bone steaks in one store

Element	Basic elemental time	Frequency element occurring per pan	Total elemental time	Frequency element occurring per package	Weighted elemental time per package 1/
	Man-minutes	Percent	Man-minutes	Percent	Man-minutes
Position tools	-	-	0.135	0.9	0.0012
Sharpen knife	-	-	.530	.2	.0011
Steel knife	-	-	.107	4.7	.0050
Position barrels	-	-	.266	.4	.0011
Talk to employee	-	-	.315	.9	.0028
Check order	-	-	.682	.1	.0007
Obtain meat from cooler	-	-	.437	5.6	.024
Position meat at saw	-	-	.081	5.6	.005
Prepare for cutting	-	-	.803	22.2	.178
Adjust saw guide	-	-	.093	6.0	.0056
Move pan from table to saw	-	-	.198	.2	.0004
Position paper on pan at saw	-	-	.147	.2	.0003
Cut on power saw and dispose	-	-	.092	100.0	.092
Unhang bone on saw guide	-	-	.124	1.9	.002
Trim meat (power saw)	-	-	.220	3.7	.008
Dispose to table from saw	-	-	.178	3.7	.007
Obtain peach paper	-	-	.074	22.2	.016
Reposition meat at table	-	-	.109	.3	.0003
Trim meat (knife)	-	-	.249	68.5	.171
Trim, scrape, and dispose	-	-	.273	31.5	.086
Scrape and dispose	-	-	.275	68.5	.188
Dispose trimmings	-	-	.196	3.2	.0063
Obtain special labels	-	-	.136	.1	.0001
Obtain towel	-	-	.170	.1	.0002
Wipe hands	-	-	.121	2.9	.0035
Dispose meat to cooler	-	-	.338	1.1	.0037
Dispose paper	-	-	.120	1.2	.0014
Clean table	-	-	.210	.5	.0010
Clean saw	-	-	.271	.2	.0005
Wash hands	-	-	.372	.1	.0004

See footnote at end of table.

Table 17.—Production standard for cutting T-bone steaks in one store—Continued

Element	Basic elemental time	Frequency element occurring per pan	Total elemental time	Frequency element occurring per package	Weighted elemental time per package 1/
	Man-minutes	Percent	Man-minutes	Percent	Man-minutes
Move to scales. . .	-	-	0.147	0.2	0.0003
Remove pan from saw	-	-	.105	3.3	.0035
Obtain pan.	0.093	60.0	.056	-	-
Obtain pan and one sheet of paper. .	.111	40.0	.044	-	-
Obtain labels . . .	.196	100.0	.196	-	-
Code labels	.175	100.0	.175	-	-
Dispose to conveyor window.	.097	56.1	.054	-	-
Dispose to conveyor end	.243	43.9	.107	-	-
Total per pan time			.632	12.2	.077

Total man-minute per package.	0.893
Personal and fatigue allowance (15 percent)	.134
Standard man-minutes per package.	1.027

1/ Values carried to fourth digit only to show value of some minor elements which might not otherwise be included.

Table 18.--Elemental time requirements per package for conventional cutting operation for selected meat cuts in a 100-percent self-service market (Store No. 1, Company No. 1)

Meat item	Average package weight	Time requirement for--								Total package time	Personal fatigue time	Standard package time
		Preparation for cutting, separation into retail cuts	Boning and trimming	Cleaning and scraping	Product handling	Pan and paper handling	Label handling	Walking	Misc. elements			
	Pounds	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Ground beef	1.15	1/ 1.019	-	-	0.094	0.023	0.010	0.013	0.029	1.188	0.178	1.366
Stew beef	.94	1/ .732	-	-	.133	.020	.042	.011	.053	.991	.149	1.140
Sirloin steak	1.57	.154	0.367	0.260	.062	.051	.054	.012	.039	.999	.150	1.149
T-bone steak	.94	.094	.357	.274	.036	.028	.045	.020	.039	.893	.134	1.027
Full round steak	1.43	.199	.035	.396	.024	.059	.020	.008	.039	.780	.117	.897
Half round steak	.77	.414	.087	-	.202	.015	.038	.002	.042	.800	.120	.920
Rib steak	.86	.172	.275	.113	.017	.021	.034	.009	.039	.680	.102	.782
Boneless rib steak	.69	.330	.283	-	.020	.011	.026	.011	.029	.710	.106	.816
Chuck roasts	2.85	.218	.237	.203	.058	.036	.017	.005	.039	.813	.122	.935
Rump roasts	3.53	.152	.043	-	.511	.028	.011	.033	.032	.810	.122	.932
Loin tip roasts	3.62	.114	.042	-	.247	.011	.044	.011	.032	.501	.075	.576
Standing rib roasts	3.88	.360	.615	-	.205	.111	.180	.048	.029	1.548	.232	1.780
Boneless rib roasts	3.73	.616	.500	-	1.452	.035	.062	.032	.032	2.729	.409	3.138
Veal chops	.51	.268	.066	.134	.109	.021	.071	.032	.039	.740	.111	.851
Veal sirloin	.90	.082	.258	.158	.066	.009	.044	.006	.039	.662	.099	.761
Veal cutlets	.52	.232	.056	-	.051	.013	.015	.007	.029	.403	.060	.463
Veal shoulder steak	.52	.060	.089	.106	.080	.028	.060	.042	.042	.507	.076	.583
Lamb chops	.80	.131	.262	.230	.021	.021	.022	.007	.039	.733	.110	.843
Lamb legs	4.74	.246	.076	-	.287	.031	.062	.084	.042	.828	.124	.952
Pork loin roasts	3.29	.267	.240	.051	.037	.017	.049	.006	.042	.709	.106	.815
Center cut pork chops	1.15	.142	.095	.399	.052	.014	.007	.004	.039	.752	.113	.865
End cut pork chops	1.16	.008	.046	.396	.047	.023	.026	.004	.039	.669	.100	.769
Pork cutlets	.85	.523	.074	-	.137	.031	.038	.097	.042	.942	.141	1.083
Half hams	6.47	.213	.166	.175	.265	.031	.046	.168	.029	1.093	.164	1.257
Center cut ham slices	.69	.101	-	.072	.044	.050	.140	.010	.039	.456	.068	.524
Fryers	2.01	1/ .799	-	-	.120	.022	.063	.057	-	1.061	.159	1.220
Chicken pieces	.79	1/ .220	-	-	.157	.012	.051	.033	-	.473	.071	.544
Lunch meat	.49	.173	-	-	.064	.004	.022	.006	.025	.294	.044	.338
Salt meat	1.63	.067	-	-	.007	.009	.012	.040	.029	.164	.025	.189
Liver (all kinds)	.49	.158	.398	-	.211	.007	.025	.041	.029	.869	.130	.999
Weighted average time per package 2/		.416	.080	.087	.099	.020	.032	.022	.029	.785	.118	.903
Percentage of total cutting time		53.0	10.2	11.1	12.6	2.5	4.1	2.8	3.7	100.0		

1/ Includes traying.

2/ Based on the actual frequency with which each of the various items occurred in the market.

Table 19 --Elemental time requirements per package for conventional cutting operation for selected meat cuts in a 92-percent self-service market (Store No. 2, Company No. 2)

Meat item	Average package weight	Time requirement for --							Total package time	Personal fatigue time	Standard package time
		Preparation for cutting, separation into retail cuts	Boning and trimming	Cleaning and scraping	Product handling	Pan and paper handling	Walking	Misc. elements			
	Pounds	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Ground beef	0.87	0.792	-	-	0.218	0.007	0.013	0.035	1.065	0.160	1.225
Stew beef	.97	.744	-	-	.023	.039	.014	.023	.843	.126	.969
Sirloin steak	1.17	.127	0.173	0.390	.089	.041	.046	.027	.893	.134	1.027
T-bone steak	.66	.078	.117	.225	.039	.038	.028	.027	.552	.083	.635
Top round steak	.79	.186	.018	-	.010	.030	.025	.023	.292	.044	.336
Bottom round steak	.67	.187	.038	-	.044	.028	.033	.023	.353	.053	.406
Boneless rib steak	.70	.219	.094	-	.020	.037	.028	.023	.421	.063	.484
Cube steak	.68	.558	.057	-	.006	.012	.025	.053	.711	.107	.818
Chuck roasts	2.68	.241	.165	.222	.029	.047	.031	.027	.762	.114	.876
Rump roasts	3.12	.185	.707	.011	.120	.035	.054	.027	1.139	.171	1.310
Pork loin roasts	3.01	.101	.008	-	.137	.028	.053	.023	.330	.050	.380
Rib end roasts	1.90	.246	.003	-	.078	.052	.045	.023	.447	.067	.514
Center cut pork chops	.87	.084	.002	-	.039	.007	.007	.023	.162	.024	.186
End cut pork chops	.83	.084	.003	-	.052	.017	.031	.023	.210	.032	.242
Pork jiffys	.67	.624	.002	-	.012	.014	.022	.056	.720	.110	.840
Spareribs	.68	.254	.002	-	.046	.019	.015	.023	.359	.054	.413
Backbone	2.02	.262	.006	-	.075	.019	.030	.023	.415	.062	.477
Butt ham	5.41	.197	.049	.060	.087	.035	.034	.023	.485	.073	.558
Shank ham	7.65	.280	.129	.121	.211	.050	.049	.023	.863	.129	.992
Center cut ham slices	.72	.054	.020	.111	.018	.009	.013	.023	.248	.037	.285
Fryers	2.09	1/ .466	-	-	.157	.004	.030	.032	.689	.103	.792
Luncheon meat	.44	.128	-	-	.061	.001	-	.005	.195	.029	.224
Salt meat	1.25	.069	-	-	.032	.007	.008	.010	.126	.019	.145
Weighted average time per package 2/		.259	.015	.017	.077	.010	.012	.019	.409	.061	.470
Percentage of total cutting time		63.3	3.7	4.2	18.8	2.4	2.9	4.7	100.0		

1/ Includes traying.

2/ Based on the actual frequency with which each of the various items occurred in the market.

Table 20.--Elemental time requirements per package for conventional cutting operation for selected meat cuts in a 55-percent self-service market (Store No. 4, Company No. 2)

Meat item	Average package weight	Time requirement for--							Total package time	Personal fatigue time	Standard package time
		Preparation for cutting, separation into retail cuts	Boning and trimming	Cleaning and scraping	Product handling	Pan and paper handling	Panning product	Misc. elements			
	Pounds	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Ground beef	1.11	0.213	0.460	-	0.060	0.011	-	0.027	0.771	0.115	0.887
Stew beef	1.12	.186	.120	-	.012	.025	0.140	.009	.492	.074	.566
Sirloin steak	1.26	.078	.194	0.199	.023	.073	.018	.014	.599	.089	.689
T-bone steak	1.12	.087	.069	.186	.028	.053	.017	.028	.468	.071	.538
Half round steak	1.14	.094	.003	-	.037	.052	.052	.016	.256	.039	.294
Rib steak	1.12	.100	.011	.144	.035	.035	.017	.029	.371	.056	.427
Jiffy steak	1.05	.629	.057	-	.027	.051	-	.091	.855	.128	.983
Chuck roasts	2.80	.148	.090	.137	.073	.062	.056	.016	.582	.086	.669
Rump roasts	4.00	.172	.192	-	.152	.144	-	.016	.675	.100	.776
Rib roasts	4.33	-	-	.043	.160	.139	.026	.016	.384	.057	.442
Brisket beef	1.22	.041	.001	.071	.031	.031	-	.017	.192	.029	.221
Pork loin roasts	3.23	-	-	-	.074	-	-	.045	.203	.030	.233
Pork rib roast	3.00	-	.042	-	.069	.036	-	.041	.188	.027	.216
Pork chops	1.10	.099	.038	-	.033	.022	.126	.072	.390	.059	.449
Butt ham	3.82	.130	-	-	.061	.008	-	.050	.249	.037	.286
Shank ham	5.62	.079	.051	-	.090	006	-	.068	.289	.044	.332
Center cut ham slices	.86	.063	-	-	.031	.022	034	.024	174	.025	200
Fryers	2.25	3.71	-	-	.115	.004	.086	.083	.659	099	.758
Chicken pieces	1.64	.369	-	-	.072	-	.020	024	485	.072	.557
Luncheon meat	.50	.128	.004	-	.026	.006	-	027	191	028	22
Salt meat	1.75	.040	-	-	.014	.012	-	.018	084	012	096
Liver	.87	.225	.057	-	.070	.001	-	.091	444	066	510
Weighted average time per package 1/		.170	.067	.025	.044	.023	.031	.038	.347	.107	455
Percentage of total cutting time		42.8	16.9	6.3	11.1	5.8	7.5	9.6	100.0		

1/ Based on the actual frequency with which each of the various items occurred in the market

Table 21.--Elemental time requirements per package for conventional cutting operation for selected meat cuts in a 50-percent self-service market (Store No. 3, Company No. 1)

Meat item	Average package weight	Time requirement for--							Total package time	Personal fatigue time	Standard package time
		Preparation for cutting, separation into retail cuts	Boning and trimming	Cleaning and scraping	Product handling	Pan and paper handling	Panning product	Misc. elements			
	Pounds	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
Ground beef	1.21	1.662	-	-	0.044	0.015	-	0.117	1.838	0.276	2.114
Stew beef	1.20	1.276	-	-	.006	.092	0.035	.030	1.439	.216	1.655
Sirloin steak	2.13	.213	0.503	0.170	.177	.113	.268	.079	1.523	.228	1.751
T-bone steak	1.41	.145	.389	.079	.051	.095	.083	.052	.894	.134	1.028
Half round steak	1.06	.294	.043	-	.026	.070	.100	.026	.559	.084	.643
Rib steak (bone in)	1.41	.486	.140	.021	.048	.069	.220	.045	1.029	.154	1.183
Rib steak (boneless)	1.22	.569	.100	-	.077	.146	.150	.030	1.072	.161	1.233
Chuck roasts	3.43	.188	.161	.106	.062	.117	.103	.117	.854	.128	.982
Boiling beef (plate)	1.22	.180	-	-	.033	.054	.067	.039	.373	.056	.429
Pork roast	2.60	.195	.047	-	.125	.049	.047	.086	.549	.082	.631
Center cut pork chops	.93	.151	.017	-	.049	.038	.124	.035	.414	.062	.476
Loin pork chops	.93	.312	.017	-	.047	.054	.185	.035	.650	.098	.748
Rib pork chops	.93	.166	.017	-	.057	.020	.117	.035	.412	.062	.474
Short ribs	1.22	.144	-	-	.044	.035	.078	.039	.340	.051	.391
Barbecue pork backs	2.00	.430	.036	-	.148	.052	.048	.088	.802	.120	.922
Half hams	6.09	.195	.055	-	.219	.128	.049	.164	.810	.122	.932
Center cut ham slices	1.13	.204	.049	.049	.114	.110	.104	.036	.666	.100	.766
End cut ham slices	.59	.136	.218	-	.616	-	.058	.036	1.064	.160	1.224
Fryers	2.25	.747	-	-	.115	.027	.124	.090	1.103	.165	1.268
Chicken pieces	1.14	.258	-	-	.049	.006	-	.035	.348	.052	.400
Luncheon meat	.31	.192	-	-	.047	-	-	.083	.322	.048	.370
Salt meat	1.15	.072	-	-	.008	.006	.002	.031	.119	.018	.137
Bacon (piece)	1.33	.094	.047	-	.017	.013	.007	.055	.233	.035	.268
Liver	.74	.399	-	-	.047	.025	-	.018	.489	.073	.562
Weighted average time per package 1/		.479	.046	.012	.062	.045	.066	.064	.774	.116	.890
Percentage of total cutting time		61.9	5.9	1.6	8.0	5.8	8.5	8.3	100.0		

1/ Based on the actual frequency with which each of the various items occurred in the market.

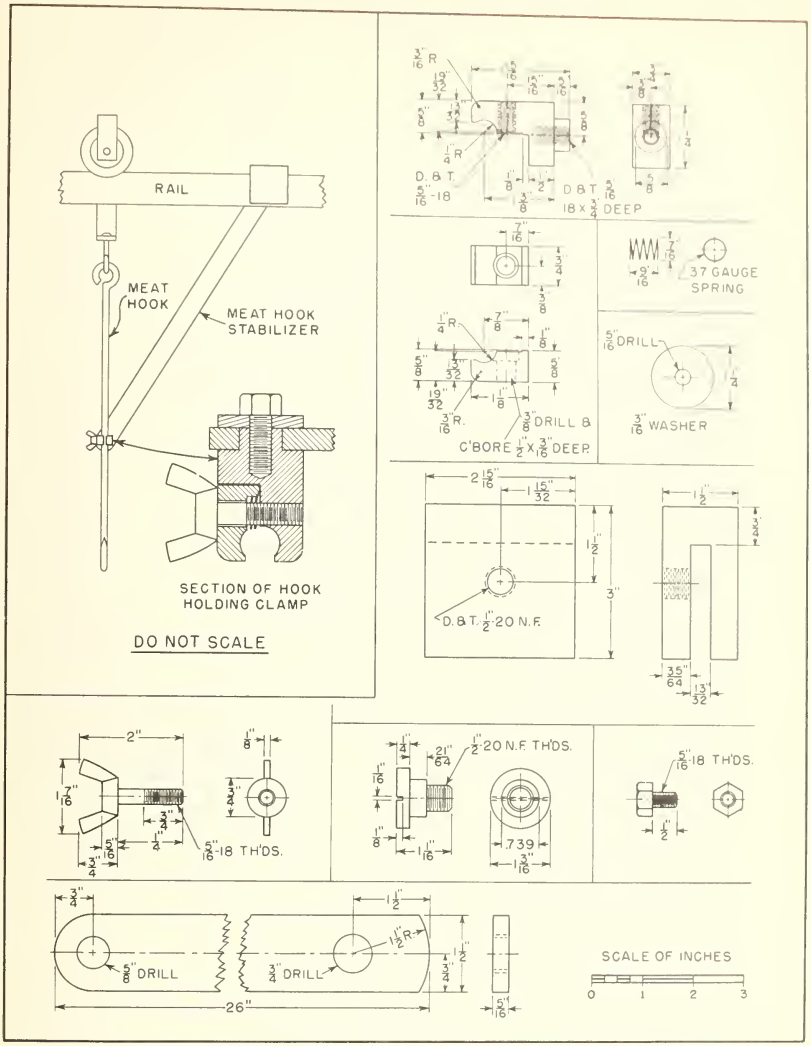


Figure 17.--Construction details for meathook stabilizer.

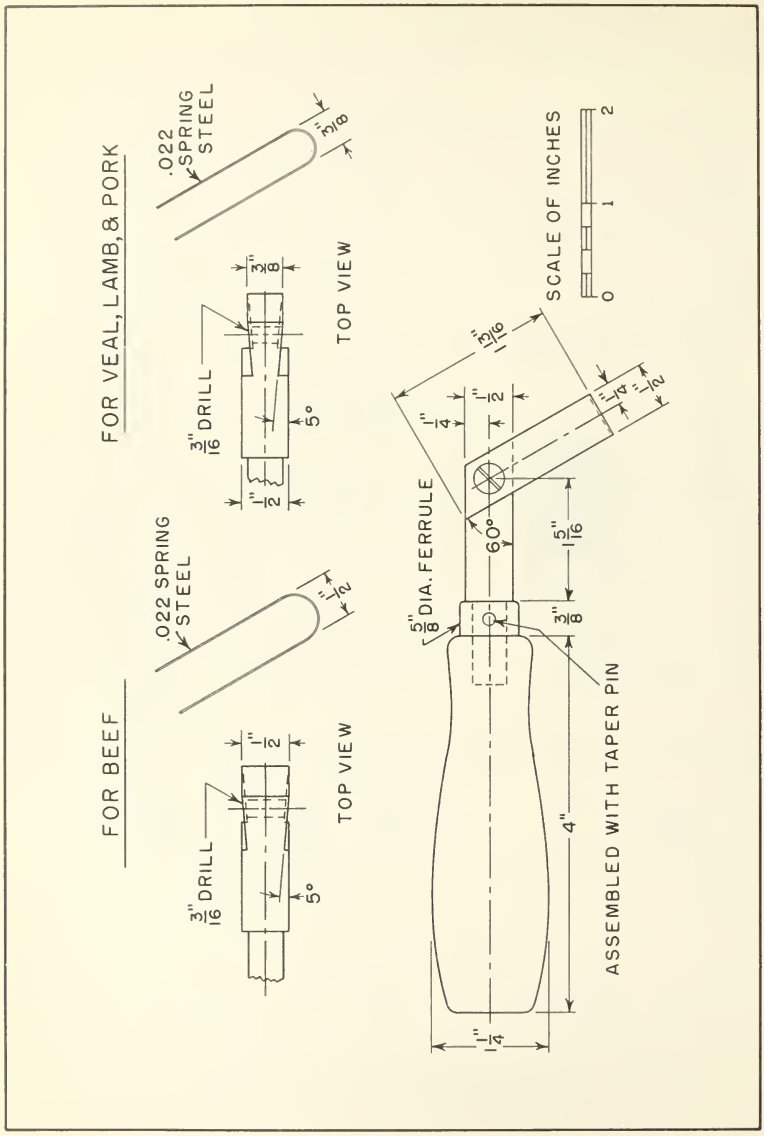


Figure 18.--Construction details for spinal cord remover.

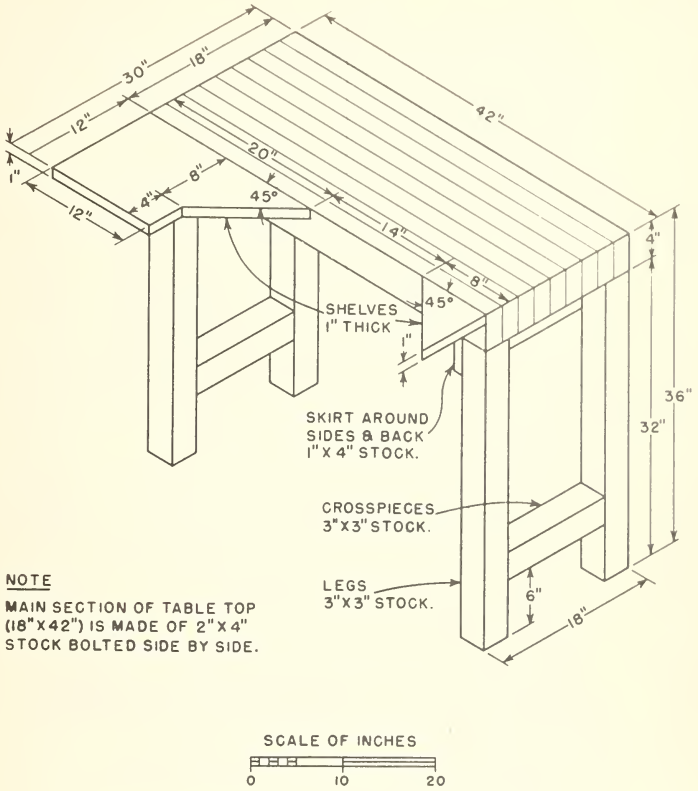


Figure 19.--Construction details for an improved cutting table.

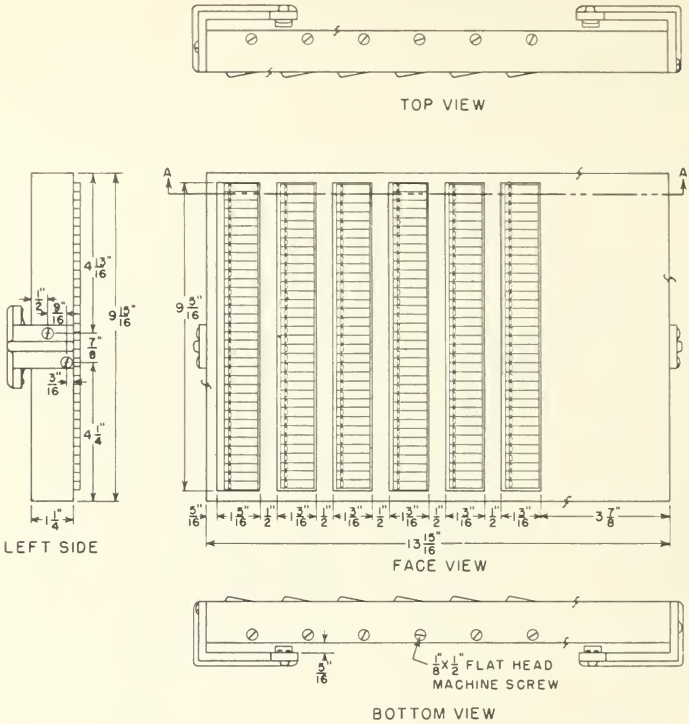
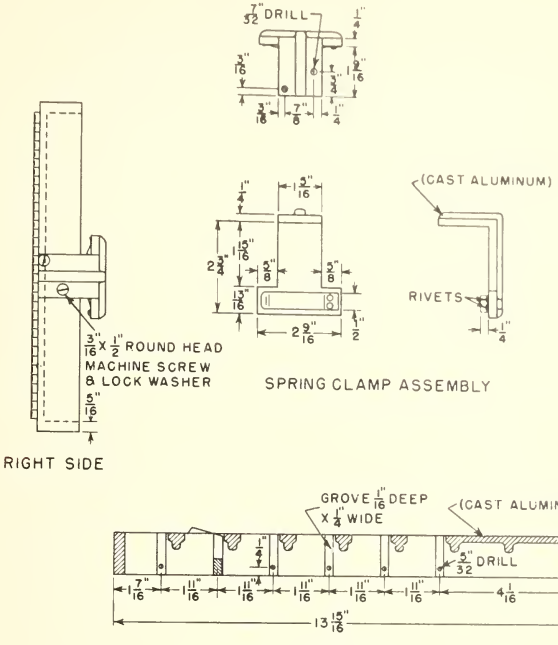


Figure 20.--Construction details for smear



remover attachment for power meat saws.

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